

Section 3

SECTION 3

POSSIBLE FUTURE CONDITIONS

This section includes a description of the planning area, technologies considered for future sewer extension projects, the planning period, and population and growth projections. Additionally, it includes a description of the proposed sewer extension projects including projected future flows and estimated construction costs.

3.1 PLANNING AREA

Although the entire Town of Merrimack was taken into consideration for the future sewer extension planning, the majority of the effort was centered on the following areas:

- Areas where sewer would flow by gravity into the existing collection system (Example: Project 3, Mayflower Drive Collector Sewers)
- Areas that are close to the existing collection system and could be easily connected (Example: Project 18, Pheasant Run Collector Sewers)
- Areas where there is a known environmental concern (Example: Projects 8, 17, 22, 31, 35, 36, 37, and 38 to extend sewer to Baboosic Lake)
- Areas where there is a known interest for development (Example: Project 2, McQuestion Road North Collector Sewers)
- Areas where there a concern about the ability of the lots to support individual septic systems (Example: Project 14, Ministerial Drive Collector Sewers and Pump Station No. 6)

There are a number of unsewered areas in Town with fairly large lot sizes that could easily support an onsite septic system and have topography that would require multiple pump stations to convey flow to the existing collection system. These areas have been eliminated from the study as onsite septic systems will be more cost effective than extending Town sewer.

3.2 WASTEWATER COLLECTION AND TREATMENT TECHNOLOGIES

The Town currently has a combination of conventional gravity sewers, inverted siphons, pumping stations to collect and convey wastewater to a centralized facility for treatment which is typical of many towns in New Hampshire. The alternative of decentralized wastewater treatment facilities was discussed early on in the master planning process for the more remote areas in Town (e.g. Baboosic Lake area); however, as the WWTF has capacity available to handle additional flows, this study focused only on conveying flows to existing facility

Another alternative that was considered in this Plan for collection and conveyance of wastewater is low pressure systems. Most typically, the Town owns the components in the public right of way (i.e. force main) and each user owns the pumping system and is responsible for maintenance as needed. In this case, the Town would adopt regulations prohibiting users from modifying the system.

3.3 PLANNING PERIOD

The planning period used for facilities planning is traditionally 20 years; therefore, the projections made in this Sewer Master Plan are through the year 2033. The intent is to provide a roadmap for any sewer extension projects that may occur during the next 20 years.

3.4 POPULATION AND GROWTH PROJECTIONS

The Town's draft Community Master Plan provides the following data on population and growth projections (Table 3-1) and the number of households and growth projections (Table 3-2).

In general, VHB points out that although the population and number of households in Merrimack are increasing, the rate of increase each year is decreasing (similar to the trends for Hillsborough County and New Hampshire). They attribute the decrease in growth rates to the fact that south-central New Hampshire has been largely built out. This is evident in the land use information for the Town of Merrimack as there are very few large parcels of land in Town that have not yet

been developed. Further, out of the 38 proposed projects which are detailed below, only 4 of those projects will serve areas that have not already been developed (Projects 2, 4, 5 and 11).

**TABLE 3-1
POPULATION AND GROWTH PROJECTIONS⁽¹⁾**

	Merrimack	Percent Increase	Hillsborough County	Percent Increase	New Hampshire	Percent Increase
1990	22,200	--	336,100	--	1,109,300	--
2000	25,100	13.1%	380,800	13.3%	1,235,800	11.4%
2010	26,500	5.6%	407,500	7.0%	1,328,200	7.5%
2015	26,800	1.1%	415,400	1.9%	1,346,300	1.4%

Note:

1. All data was provided by the U.S. Census Bureau, DemographicsNow & RKG Associates, Inc. 2011 including the 2015 projections.

**TABLE 3-2
NUMBER OF HOUSEHOLDS AND GROWTH PROJECTIONS⁽¹⁾**

	Merrimack	Percent Increase	Hillsborough County	Percent Increase	New Hampshire	Percent Increase
1990	7,440	--	124,570	--	411,190	--
2000	8,830	18.7%	144,460	16.0%	474,610	15.4%
2010	9,280	5.1%	152,440	5.5%	512,160	7.9%
2015	9,380	1.1%	155,490	2.0%	524,890	2.5%

Note:

1. All data was provided by the U.S. Census Bureau, DemographicsNow & RKG Associates, Inc. 2011 including the 2015 projections.

3.5 FUTURE FLOW PROJECTIONS

The following is a brief summary of the process used to determine the future flow projections for this Plan as well as assumptions made. The average daily flow projections for each project are listed under the individual project descriptions in Section 3.6.

3.5.1 Residential Average Daily Flow Projection Method

NHDES and Town standards call for a minimum of 70 gallons per day per capita (GPDC) to be used for wastewater flow projections. Town standards indicate population densities of 3.5 people per single-family unit and 2 people per multi-family unit be assumed. The draft

Community Master Plan indicates that the average household population in 2010 was 2.85 and that 98 percent of private homes are single family. Therefore, for purposes of this study, three people per parcel has been assumed as the GIS data does not differentiate between single and multi-family units; thus the average daily flow for one residential parcel has been assumed to be 210 gallons per day (GPD).

3.5.2 Alternative Average Daily Flow Projection Methods

Although the majority of the projects areas are residential, there were two projects areas with other types of flow as listed below. The methods for projecting future non-residential flows are described in Section 3.6 under each project description as each case was handled differently.

- Project 11 (Alternative B): This alternative includes rerouting the existing Pennichuck Pump Station force main to the Continental Boulevard interceptor extension.
- Project 7: This project assumes that the existing properties will be redeveloped into commercial or light industrial properties as a result of the new airport exit being constructed just over the town line in Bedford.

3.5.3 Infiltration Allowance

According to NHDES standards, an allowance is assumed for infiltration in developed areas to be served by future gravity sewers of 300 GPD per inch-diameter-mile of sewer (GPD/In-Diam-Mi). Based on our experience, this infiltration allowance provides a conservatively high estimate of infiltration and will be used. An infiltration allowance has not been included for low pressure systems as there is minimal infiltration in systems with individual grinder stations and pressure piping. Note that when estimating peak flow rates, the peaking factor is only applied to sanitary flows and not the infiltration allowance.

3.5.4 Peaking Factors

Per NHDES and Town standards, the factor applied to average daily flows to determine peak flows for average daily flows less than 100,000 GPD is 6. For flows higher than 100,000 GPD,

the NHDES standard refers to a figure in *TR-16*¹ where the peaking factor is selected based on the average daily flow. Based on the flow estimates for most of the proposed projects, the graph indicates a peaking factor of 4.5 to 6. In our experience, these peaking factors are very conservative. In addition, the average daily flows used in the flow projections which are noted above are already on the conservative side. Using overly conservative peaking factors on top of the conservative average daily flow can result in unrealistic peak flow projections which could then result in oversized facilities.

Actual peaking factors observed at various locations throughout town are as follows:

- Conifer Street Siphon: The flow metering that the Town completed to collect data for the hydraulic model indicated that the peaking factor at the Conifer Street siphon was 1.8.
- The daily pump station flow data for January 2009 through July 2012 indicates peaking factors of 3.4 and 2.9 respectively for Thornton's Ferry and Souhegan Pump Stations.
- The flow data at the WWTF from November 2009 through July 2012 indicates a peaking factor of about 2.7.

For the existing pump stations and treatment plant, we will use the actual current peaking factors to estimate future flow. However, for the Conifer Street siphon² and future projects, the following peaking factors will be used:

- Average daily flows less than 100,000 GPD: PF = 4.0
- Average daily flows between 100,000 GPD and 200,000 GPD: PF = 3.5
- Average daily flows greater than 200,000: PF = 3.0

The following equation was applied to calculate peak daily flow (PDF) from average daily flow (ADF):

$$\text{PDF} = (\text{ADF} \times \text{PF}) + \text{Infiltration Allowance}$$

¹ TR-16 Guides for the Design of Wastewater Treatment Works, New England Interstate Water Pollution Control Commission, 2011 Edition, Figure 2-1 – Ratio of Extreme Flow to Average Daily Flow.

² We feel that a more conservative peaking factor should be used for the Conifer Street siphon as the peaking factor of 1.8 is based on a few months of flow data as opposed to several years of data.

3.6 PROJECT DESCRIPTIONS

The following is a brief summary of each of the projects identified through meetings with Town personnel in conjunction with the review of current GIS mapping, the 1977 Interceptor and Trunk Sewers Facility Plan by Hamilton Engineering Associates, Inc. and the 1991 Sewerage System Extension Study by Underwood Engineers, Inc.

Included in each summary is a conceptual description of the sewer to serve the area, the basis for the flow projections (number of residential units, assumptions made regarding any proposed future development, etc.), the projected sanitary flow and infiltration allowance, and the estimated cost of the conceptual plan for the area. The number of residential units was estimated based on the number of parcels in a project area unless otherwise noted. A summary of the projected average daily flows for each project is included in Appendix C.

The project areas are shown on Figure 3-1 at the end of this section. The boundaries of the projects are approximate only and may be modified during future development of the project and design of the sewers to include some of the properties adjacent to the identified areas if necessary.

Many of the proposed projects are dependent on another downstream project being constructed first (e.g. the Baboosic Lake area). Where applicable, the required downstream projects are noted at the end of the description for each project. For example, Project 8 (the first phase of the Baboosic Lake interceptor extension) must be completed before Projects 31 (Bean Road Collector Sewers and Pump Station No. 4) and 37 (the second phase of the Baboosic Lake interceptor extension), but Project 31 can be completed before Project 37. Additionally, Projects 8 and 37 would need to be completed before Project 35 (Greatstone Drive Collector Sewers and Pump Station No. 3). These projects have been grouped as follows:

- Project Grouping 1: extend sewer to Baboosic Lake (Projects 8, 17, 22, 31, 35, 36, 37 and 38)
- Project Grouping 2: extend sewer to north-central Merrimack (Projects 5, 6, 10, 23, 24, 28 and 33)

- Project Grouping 3: extend sewer to neighborhoods to the north and south of east Bedford Road (Projects 14, 19 and 21)
- Project Grouping 4: extend sewer to neighborhoods to the north and south of Amherst Road (Projects 29, 30 and 34)

The projects detailed below are not presented in order of project number as the project numbers have been assigned to reflect the final project ranking as defined in Section 6. The projects that are part of a project grouping are presented first (beginning at the most downstream project), followed by the two alternatives for the Continental Boulevard Interceptor Extension project followed by the remaining projects (listed by project number).

Cost estimates for the conceptual sewer plans for each project are approximate and intended only to provide an indication of the order of magnitude of possible costs to serve each area. For estimating purposes, the unit prices summarized in Table 3-3 were used. Gravity sewer unit prices are applied to the estimated main line sewer lengths and include costs for manholes, service laterals to the edge of the right-of-way and pavement restoration. The ledge factors listed below are applied to all collector sewer and interceptor quantities. In addition to construction costs, allowances have been included as follows: contingency (20%), engineering services (20% for design, inspection, etc.) and legal and administrative costs (2% for financing fees, etc.). Costs are based on an ENR Index of 9412 (December 2012)

**TABLE 3-3
CONSTRUCTION COST ESTIMATE UNIT PRICES**

Item Description	Unit Price
Collector Sewers (8-inch diameter)	\$160/LF
Interceptor (10 to 15-inch diameter)	\$190/LF
Interceptor (16 to 18-inch diameter)	\$210/LF
Gravity Sewer Ledge Factor	\$30/LF
Force Main	\$100/LF
Force Main Ledge Factor	\$15/LF
Pump Station	\$500,000/EA
Low Pressure Sewers	\$115/LF
Low Pressure Sewer Grinder Stations	\$9,000/EA
Siphon	\$90,000/EA

Pump stations are recommended for several projects. Smaller pump stations would likely be submersible grinder style stations (<50 gallons per minute, GPM) and larger pump stations would likely be suction lift style stations similar to Pearson Road or Heron Road Pump Stations (>120 GPM). All pump stations are assumed to include a generator building to house an emergency generator and all electrical and control equipment. Although the cost for a submersible grinder style station will likely be somewhat less than the cost for a suction lift style pump station, the same unit prices for pump stations and force mains have been used for planning level purposes since the exact location and site conditions are unknown at this time.

At the end of each of the Project Grouping sections, there is a summary of the total cost for the Project Grouping broken down by interceptor costs, pump station/force main costs and gravity sewer costs.

3.6.1 Project Grouping 1

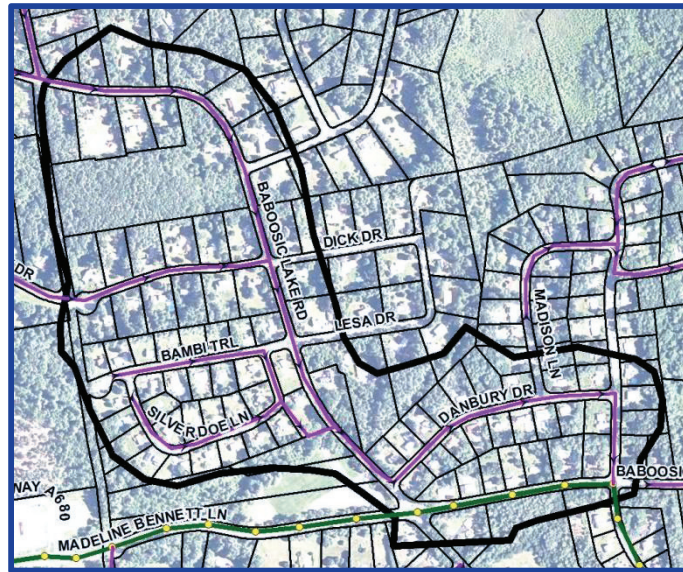
This project grouping consists of eight different projects to extend sewer from the intersection of Maidstone Drive and Baboosic Lake Road to the Baboosic Lake area and a number of smaller neighborhoods adjacent to Baboosic Lake Road and Baboosic Lake. Each individual project is summarized below.

3.6.1.1 Project 8: Baboosic Lake Road Interceptor Extension, Phase I

This project involves extending a 12-inch diameter interceptor approximately 4,930 linear feet from the intersection of Baboosic Lake Road and Maidstone Drive north along Maidstone Drive, west along Danbury Drive and then northwest along Baboosic Lake Road to the intersection with Bean Road. It also involves constructing approximately 3,200 linear feet of 8-inch diameter collector sewers in Bambi Lane, Silver Doe Lane and part of Marty Drive. Refer to Figure 3-2 for the extents of the proposed project area.

There are approximately 80 residential housing units that could be served by gravity sewer within this project area with a projected average daily flow of 21,600 GPD (sanitary flow of 16,800 GPD and infiltration flow of 4,800 GPD).

**FIGURE 3-2
PROJECT 8: BABOOSIC LAKE ROAD
INTERCEPTOR EXTENSION, PHASE I**



The estimated cost for the interceptor portion of this project is \$1,590,000 and for the collector sewer portion is \$890,000 for a total project cost of \$2,480,000.

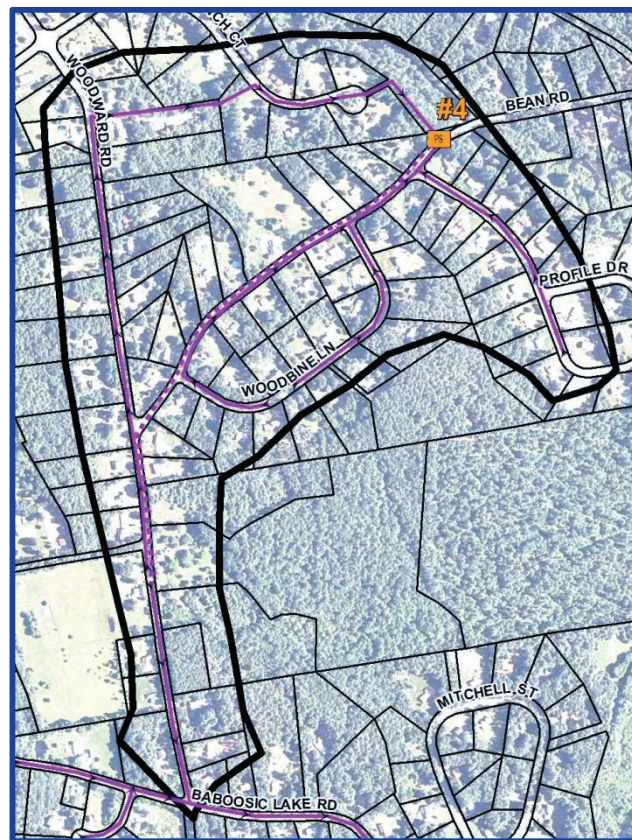
3.6.1.2 Project 31: Bean Road Collector Sewers and Pump Station No. 4

This project involves constructing approximately 10,700 linear feet of 8-inch diameter collector sewers to the north of Baboosic Lake Road in Bean Road, Woodward Road, Woodbine Lane, Profile Drive and French Court. It also involves constructing Pump Station No. 4 on Bean Road and approximately 2,880 linear feet of force main to convey flows to a short section of gravity sewer in Bean Road which drains to the interceptor extension in Baboosic Lake Road. The pump station will see peak flows of approximately 77,100 GPD and will likely be a suction lift style station sized for 120 GPM. Refer to Figure 3-3 for the extents of the proposed project area.

There are approximately 86 residential housing units that could be served by gravity sewer within this project area with a projected average daily flow of 22,900 GPD (sanitary flow of 18,100 GPD and infiltration flow of 4,800 GPD).

The estimated cost for this project is \$4,190,000. Phase I of the Baboosic Lake interceptor extension must be constructed before this project (Project 8).

FIGURE 3-3
PROJECT 31: BEAN ROAD COLLECTOR
SEWERS AND PUMP STATION NO. 4



3.6.1.3 Project 37: Baboosic Lake Road Interceptor Extension, Phase II

This project involves extending a 12-inch diameter interceptor approximately 3,030 linear feet from the intersection of Baboosic Lake Road and Bean Road northwest along Baboosic Lake Road to the intersection with Greatstone Drive and Marty Drive. It also involves constructing approximately 1,330 linear feet of 8-inch diameter collector sewers in Mary Paul Lane, Cavalier Country Road, and part of Tomahawk Drive. Refer to Figure 3-4 for the extents of the proposed project area.

There are approximately 28 residential housing units that could be served by gravity sewer within this project area with a projected average daily flow of 8,500 GPD (sanitary flow of 5,900 GPD and infiltration flow of 2,600 GPD).

FIGURE 3-4
PROJECT 37: BABOOSIC LAKE ROAD INTERCEPTOR EXTENSION,
PHASE II



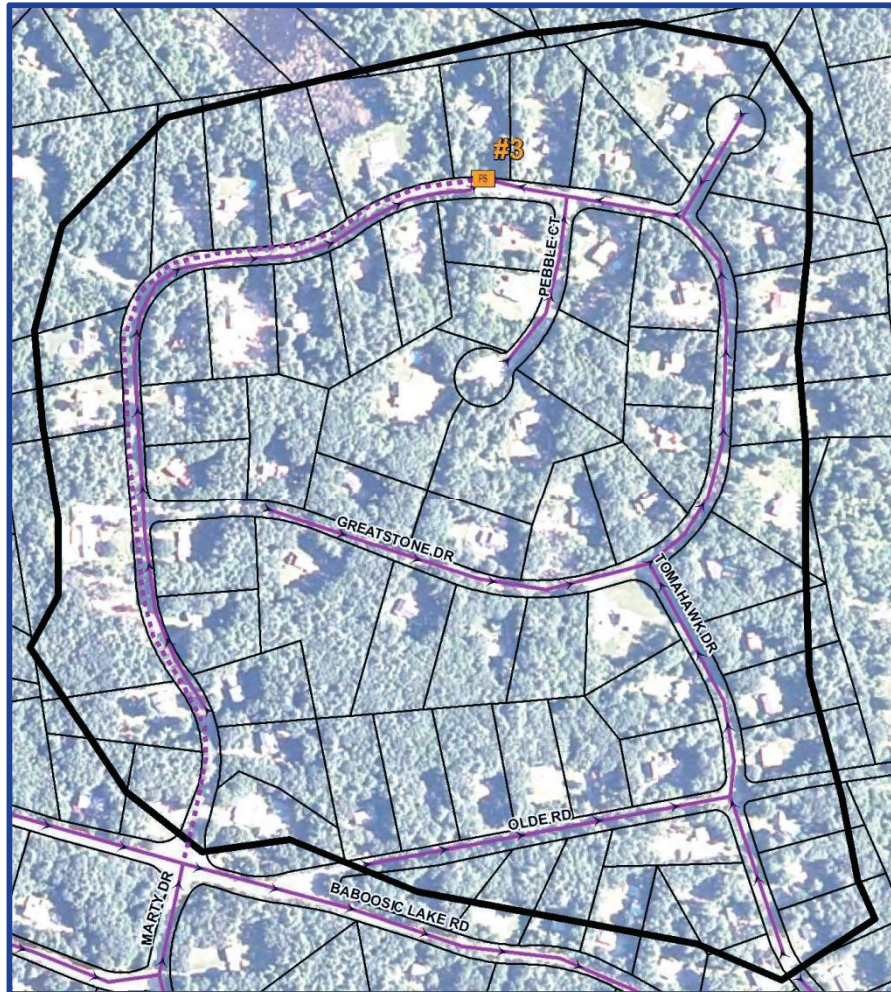
The estimated cost for the interceptor portion of this project is \$970,000 and for the collector sewer portion is \$370,000 for a total project cost of \$1,340,000. Phase I of the Baboosic Lake interceptor extension must be constructed before this project (Project 8).

3.6.1.4 Project 35: Greatstone Drive Collector Sewers and Pump Station No. 3

This project involves constructing approximately 7,630 linear feet of 8-inch diameter collector sewers to the north of Baboosic Lake Road in Greatstone Drive, Pebble Court, Goldstone Circle, Olde Road and part of Tomahawk Drive. It also involves constructing Pump Station No. 3 on Greatstone Drive and approximately 2,550 linear feet of force main to convey flows to the interceptor extension in Baboosic Lake Road. The pump station will see peak flows of

approximately 54,700 GPD and will likely be a submersible grinder style station sized for 50 GPM. Refer to Figure 3-5 for the extents of the proposed project area.

**FIGURE 3-5
PROJECT 35: GREENSTONE DRIVE COLLECTOR
SEWERS AND PUMP STATION NO. 3**



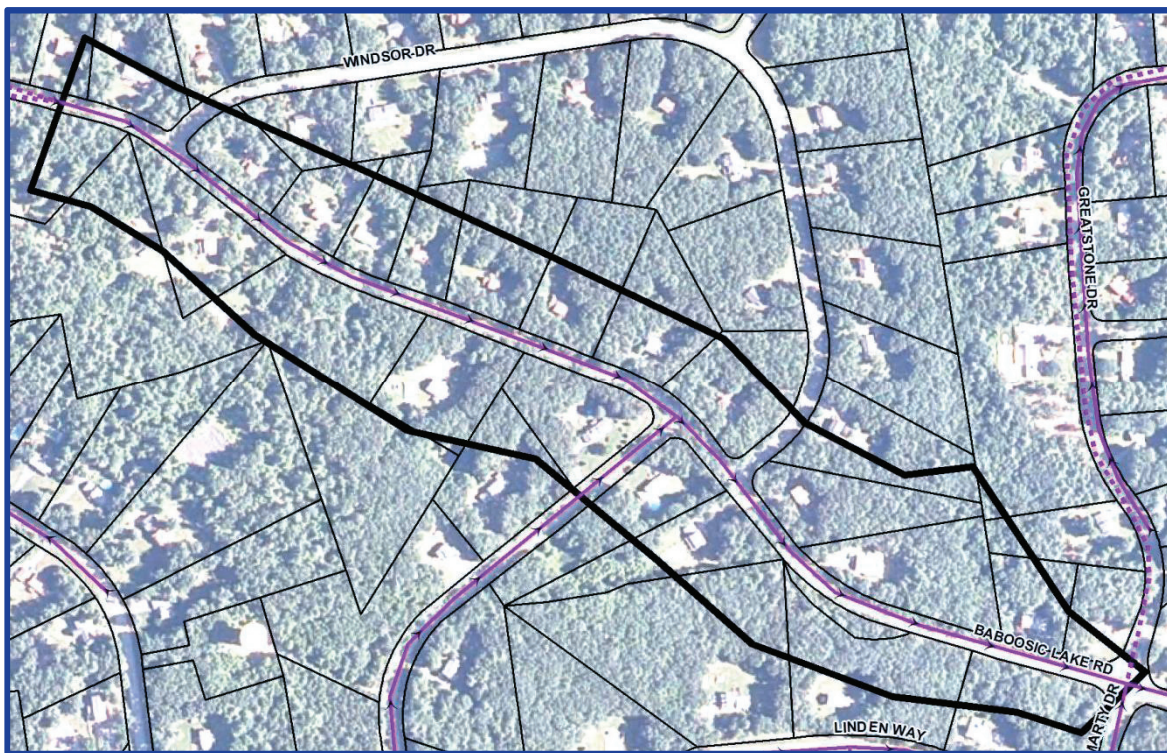
There are approximately 61 residential housing units that could be served by gravity sewer within this project area with a projected average daily flow of 16,300 GPD (sanitary flow of 12,800 GPD and infiltration flow of 3,500 GPD).

The estimated cost for this project is \$3,280,000. Phases I and II of the Baboosic Lake interceptor extension must be constructed before this project (Projects 8 and 37).

3.6.1.5 Project 36: Baboosic Lake Road Interceptor Extension, Phase III

This project involves extending a 12-inch diameter interceptor approximately 3,250 linear feet from the intersection with Greatstone Drive and Marty Drive northwest along Baboosic Lake Road to just beyond the northwest end of Windsor Drive. Refer to Figure 3-6 for the extents of the proposed project area.

**FIGURE 3-6
PROJECT 36: BABOOSIC LAKE ROAD INTERCEPTOR EXTENSION,
PHASE III**



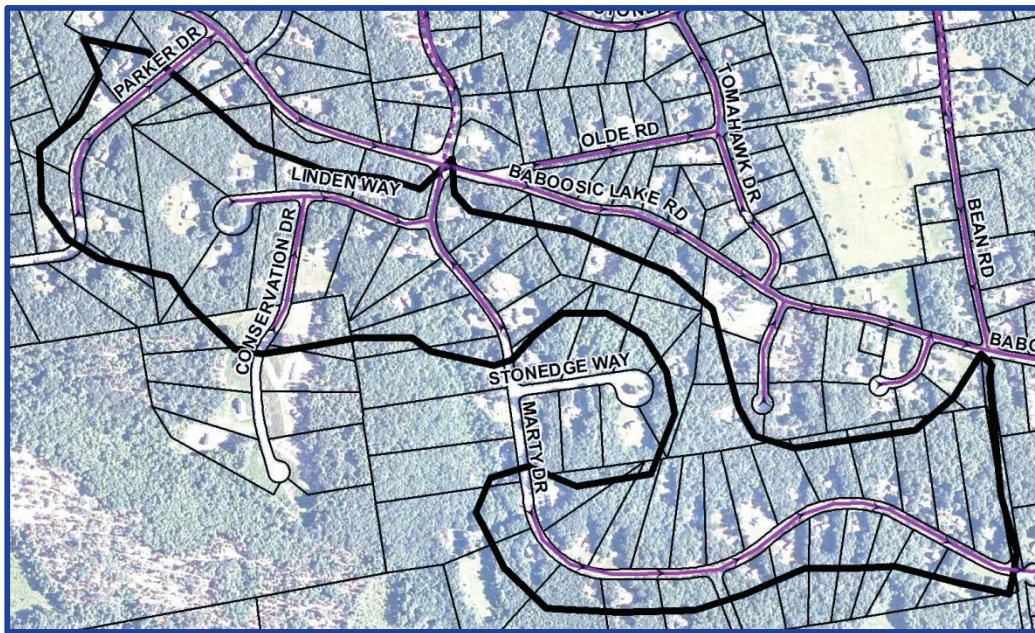
There are approximately 22 residential housing units that could be served by gravity sewer within this project area with a projected average daily flow of 6,800 GPD (sanitary flow of 4,600 GPD and infiltration flow of 2,200 GPD).

The estimated cost for this project is \$1,050,000. Phases I and II of the Baboosic Lake interceptor extension must be constructed before this project (Projects 8 and 37).

3.6.1.6 Project 38: Baboosic Lake Road South Collector Sewers

This project involves constructing approximately 6,630 linear feet of 8-inch diameter collector sewers to the south of Baboosic Lake Road in part of Marty Drive, Linden Way, Conservation Drive and part of Parker Drive. Refer to Figure 3-7 for the extents of the proposed project area.

**FIGURE 3-7
PROJECT 38: BABOOSIC LAKE ROAD SOUTH
COLLECTOR SEWERS**



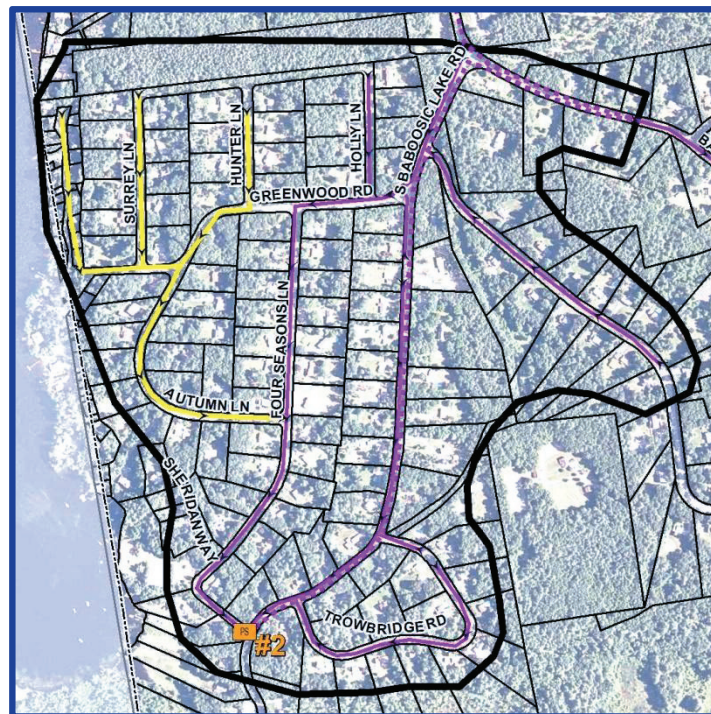
There are approximately 44 residential housing units that could be served by gravity sewer within this project area with a projected average daily flow of 12,300 GPD (sanitary flow of 9,200 GPD and infiltration flow of 3,100 GPD).

The estimated cost for this project is \$1,840,000. Phases I, II and III of the Baboosic Lake interceptor extension must be constructed before this project (Projects 8, 36 and 37).

3.6.1.7 Project 17: Baboosic Lake South Collector Sewers and Pump Station No. 2

This project involves constructing approximately 10,600 linear feet of 8-inch diameter collector sewers in South Baboosic Lake Road, part of Parker Drive, Trowbridge Road, part of Greenwood Road, Holly Lane and Four Seasons Lane and approximately 4,580 linear feet of low pressure sewers in Autumn Lane, Hunter Lane, Surrey Lane, Lakeside Drive and part of Greenwood Road. Note that this project could also potentially collect flows from an existing development in Amherst. It also involves constructing Pump Station No. 2 on South Baboosic Lake Road and approximately 4,250 linear feet of force main to convey flows to the interceptor extension in Baboosic Lake Road. The pump station will see peak flows of approximately 163,500 GPD and will likely be a suction lift style station sized for 150 GPM. Refer to Figure 3-8 for the extents of the proposed project area.

**FIGURE 3-8
PROJECT 17: BABOOSIC LAKE SOUTH
COLLECTOR SEWERS AND
PUMP STATION NO. 2**



There are approximately 186 residential housing units that could be served by gravity sewer or by low pressure sewer within this project area (this includes 54 units from Amherst) with a projected average daily flow of 46,300 GPD (sanitary flow of 39,100 GPD and infiltration flow of 7,200 GPD).

The estimated cost for this project is \$5,640,000. Phases I, II and III of the Baboosic Lake interceptor extension must be constructed before this project (Projects 8, 36 and 37).

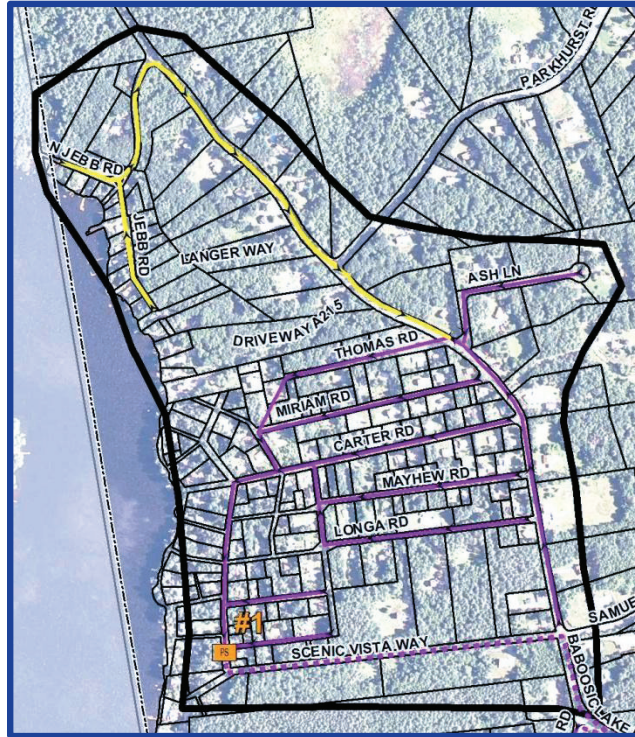
3.6.1.8 Project 22: Baboosic Lake North Collector Sewers and Pump Station No. 1

This project involves constructing approximately 11,130 linear feet of 8-inch diameter collector sewers in Baboosic Lake Road, Ash Lane, Thomas Road, Miriam Drive, Carter Road, Mayhew Road, Longa Road, Rennie Road, Arnold Road, Shore Drive, Richards Road and Donald Road and approximately 3,830 linear feet of low pressure sewers in Baboosic Lake Road, Jebb Road and North Jebb Road. It also involves constructing Pump Station No. 1 on Shore Drive and approximately 3,130 linear feet of force main to convey flows to the interceptor extension in Baboosic Lake Road. The pump station will see peak flows of approximately 140,300 GPD and will likely be a suction lift style station sized for 120 GPM. Refer to Figure 3-9 for the extents of the proposed project area.

There are approximately 161 residential housing units that could be served by gravity sewer or by low pressure sewer within this project area with a projected average daily flow of 38,900 GPD (sanitary flow of 33,800 GPD and infiltration flow of 5,100 GPD).

The estimated cost for this project is \$5,390,000. Phases I, II and III of the Baboosic Lake interceptor extension must be constructed before this project (Projects 8, 36 and 37).

**FIGURE 3-9
PROJECT 22: BABOOSIC LAKE
NORTH COLLECTOR SEWERS
AND PUMP STATION NO. 1**



3.6.1.9 Project Grouping 1 Cost Summary

The cost summary to construct the proposed interceptors, pump station/force main and gravity sewers in Project Grouping 1 is as follows:

Interceptors	\$3,610,000
Pump Station/Force Main	\$5,090,000
Gravity Sewers	<u>\$16,510,000</u>
Total Project Grouping 1 Cost	\$25,210,000

3.6.2 Project Grouping 2

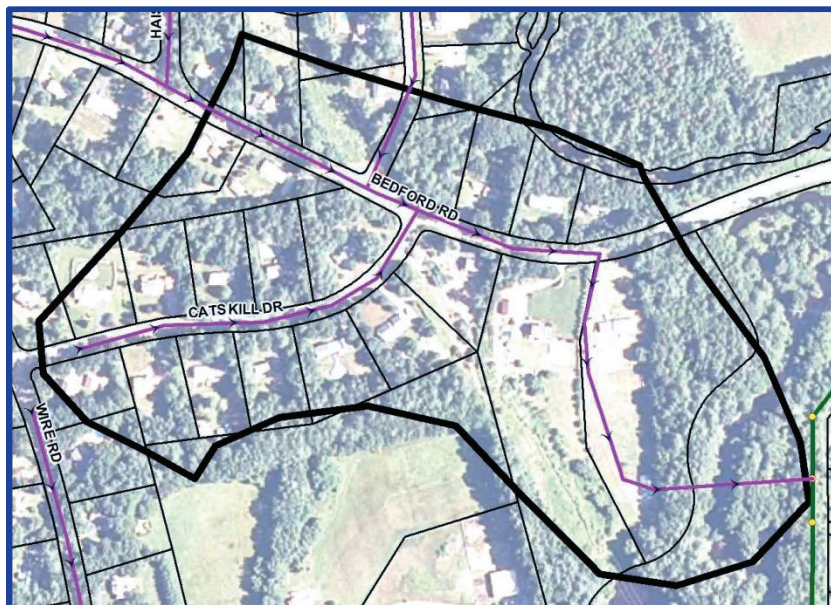
This project grouping consists of seven different projects to extend sewer from the existing cross-country interceptor to the west of Bramber Lane to the northwest along Bedford Road to

Falcon Drive, southwest along Falcon Drive to Robin Way, south to the end of Robin Way, southwest cross-country to Joppa Road, south on Joppa Road to Patten Road, and continuing on Patten Road to the intersection with Baboosic Lake Road. These projects will also provide sewer to a number of neighborhoods adjacent to the interceptor route. Each individual project is summarized below.

3.6.2.1 Project 23: Northern Merrimack Interceptor Extension, Phase I

This project involves extending a 12-inch diameter interceptor approximately 2,300 linear feet from the existing cross-country interceptor to the west of Bramber Lane northwest along Bedford Road to the intersection with Haise Way. A new six-inch double barrel siphon will be constructed beneath Baboosic Brook to connect the new interceptor to the existing interceptor. The project also involves constructing approximately 1,000 linear feet of 8-inch diameter collector sewers in Catskill Drive. Refer to Figure 3-10 for the extents of the proposed project area.

**FIGURE 3-10
PROJECT 23: NORTHERN MERRIMACK
INTERCEPTOR EXTENSION, PHASE I**



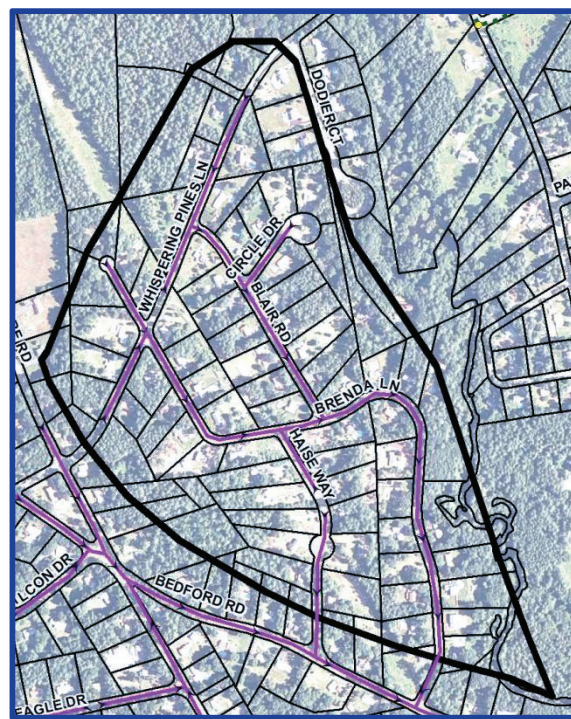
There are approximately 24 residential housing units that could be served by gravity sewer within this project area with a projected average daily flow of 7,100 GPD (sanitary flow of 5,100 GPD and infiltration flow of 2,000 GPD).

The estimated cost for the interceptor portion of this project is \$870,000 and for the collector sewer portion is \$280,000 for a total project cost of \$1,150,000.

3.6.2.2 Project 5: Bedford Road North Collector Sewers

This project involves constructing approximately 7,730 linear feet of 8-inch diameter collector sewers to the north of Bedford Road in Brenda Lane, Haise Way, Blair Road, Circle Drive and Whispering Pines Lane. Note that this project area could also potentially collect flows for a future development between Wire Road and Whispering Pines Lane. Refer to Figure 3-11 for the extents of the proposed project area.

**FIGURE 3-11
PROJECT 5: BEDFORD ROAD
NORTH COLLECTOR SEWERS**



There are approximately 109 residential housing units that could be served by gravity sewer within this project area (this includes 40 units in the potential future development) with a projected average daily flow of 27,400 GPD (sanitary flow of 22,900 GPD and infiltration flow of 4,500 GPD).

The estimated cost for this project is \$2,150,000. Note that this cost does not include construction of the sewer in the new development. Phase I of the Northern Merrimack interceptor extension must be constructed before this project (Project 23).

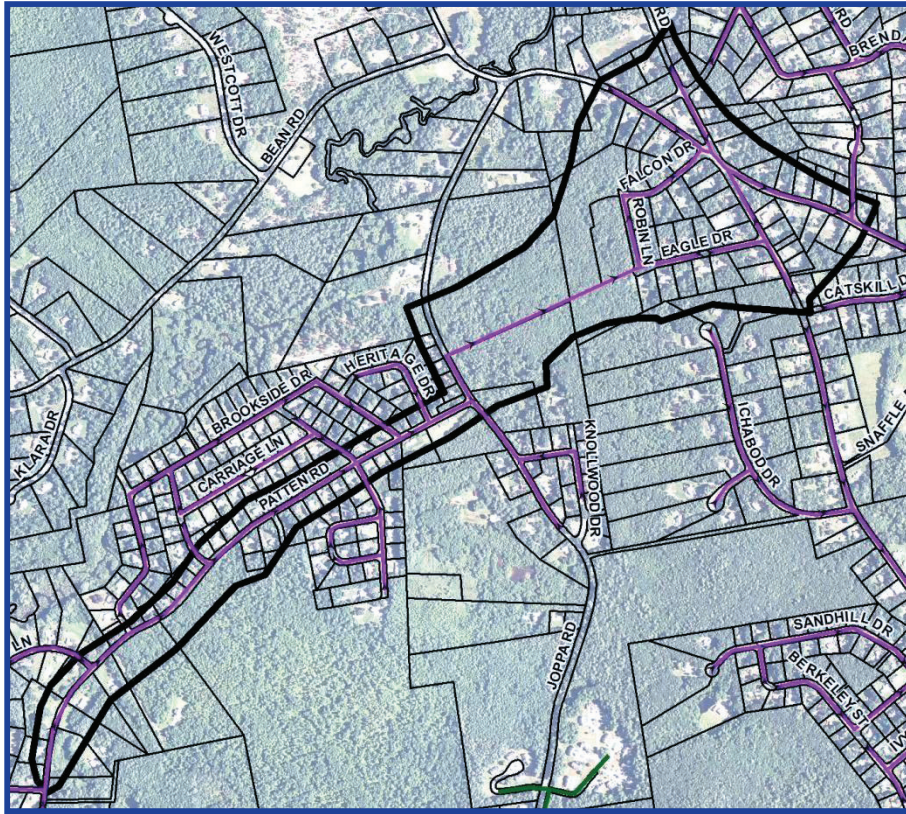
3.6.2.3 Project 10: Northern Merrimack Interceptor Extension, Phase II

This project involves extending a 12-inch diameter interceptor approximately 9,500 linear feet from the intersection with Haise Way northwest along Bedford Road to Falcon Drive, southwest along Falcon Drive to Robin Way, south to the end of Robin Way, southwest cross-country to Joppa Road, south on Joppa Road to Patten Road, and southwest on Patten Road to the intersection with the south end of Jakes Lane. It also involves constructing approximately 3,750 linear feet of 8-inch diameter collector sewers in part of Bedford Road, part of Wire Road and Eagle Drive. Refer to Figure 3-12 for the extents of the proposed project area.

There are approximately 105 residential housing units that could be served by gravity sewer within this project area with a projected average daily flow of 30,200 GPD (sanitary flow of 22,100 GPD and infiltration flow of 8,100 GPD).

The estimated cost for the interceptor portion of this project is \$3,060,000 and for the collector sewer portion is \$1,040,000 for a total project cost of \$4,100,000. Phase I of the Northern Merrimack interceptor extension must be constructed before this project (Project 23).

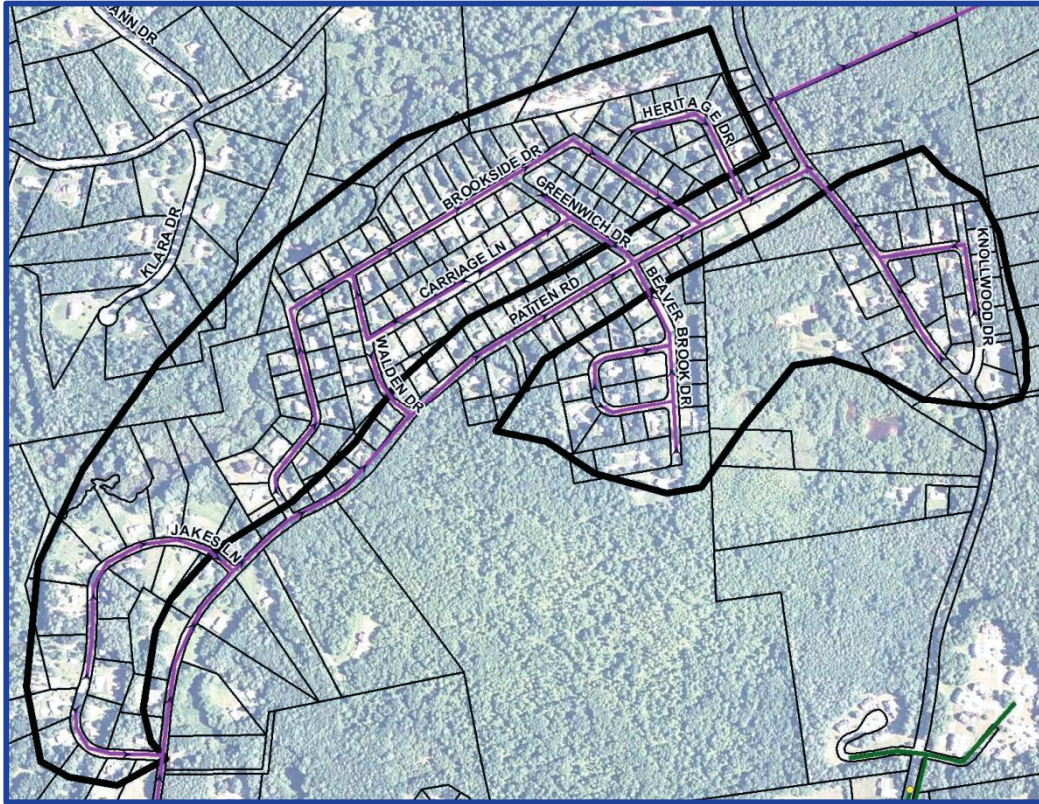
FIGURE 3-12
PROJECT 10: NORTHERN MERRIMACK
INTERCEPTOR EXTENSION, PHASE II



3.6.2.4 Project 6: Patten Road North Collector Sewers

This project involves constructing approximately 12,680 linear feet of 8-inch diameter collector sewers along northern Patten Road including Heritage Drive, Brookside Drive, Carriage Lane, Greenwich Drive, Walden Drive, King Henry Court and Beaver Brook Drive as well as along Joppa Road including Knollwood Drive and Ridgewood Drive. Note that this project is geographically divided into two sections by Project 10 (see the project area shown on Figure 3-12). Due to the relatively small area to be sewered on Beaver Brook Drive, Joppa Road and Hollywood Drive to the south of Project 10, it was included in this project rather than creating a separate project. Refer to Figure 3-13 for the extents of the proposed project area.

FIGURE 3-13
PROJECT 6: PATTEN ROAD NORTH COLLECTOR SEWERS



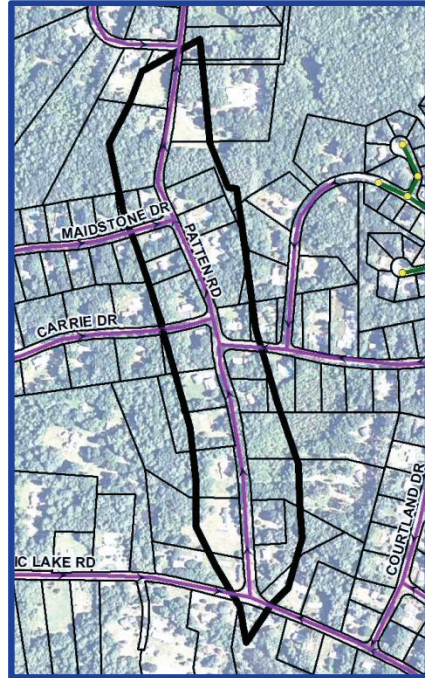
There are approximately 147 residential housing units that could be served by gravity sewer within this project area with a projected average daily flow of 36,600 GPD (sanitary flow of 30,900 GPD and infiltration flow of 5,700 GPD).

The estimated cost for this project is \$3,530,000. Phases I and II of the Northern Merrimack interceptor extension must be constructed before this project (Projects 10 and 23).

3.6.2.5 Project 33: Northern Merrimack Interceptor Extension, Phase III

This project involves extending a 12-inch diameter interceptor approximately 2,880 linear feet from the intersection Patten Road and Jakes Lane south along Patten Road to the intersection with Baboosic Lake Road. Refer to Figure 3-14 for the extents of the proposed project area.

FIGURE 3-14
PROJECT 33: NORTHERN
MERRIMACK INTERCEPTOR
EXTENSION, PHASE III



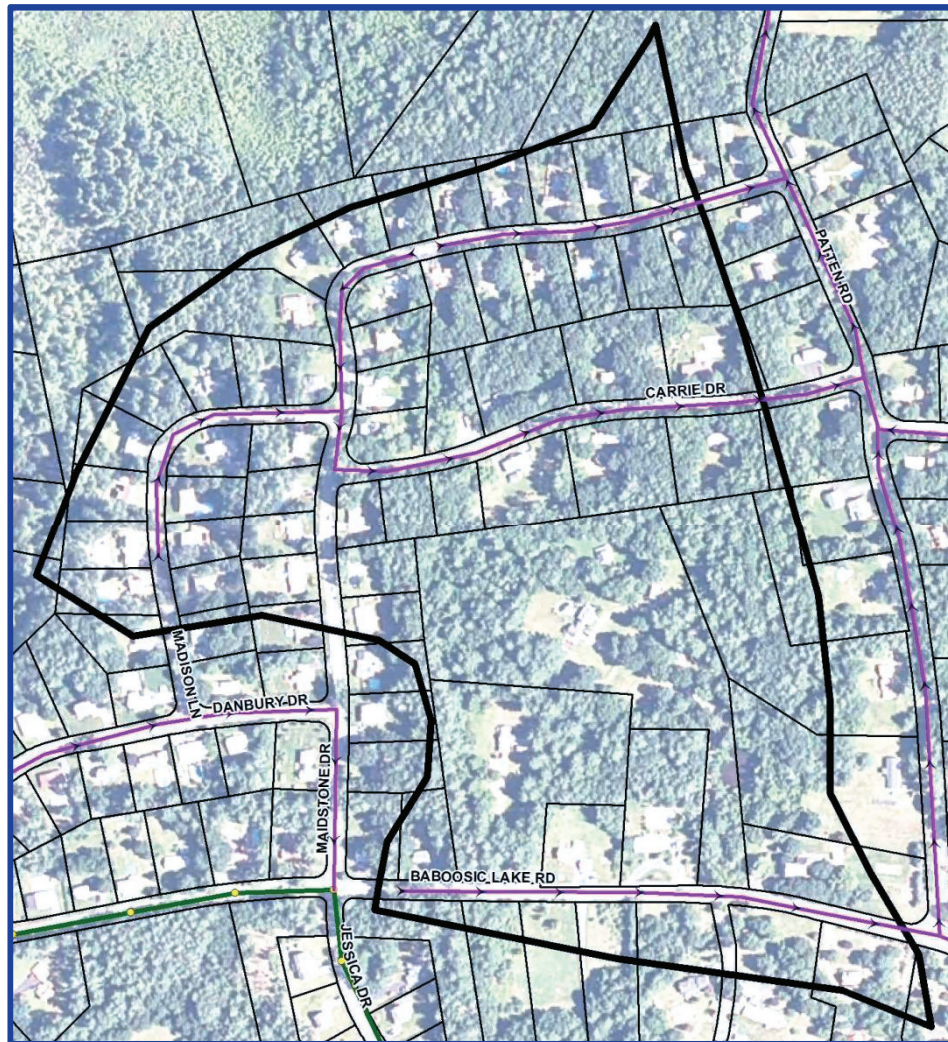
There are approximately 22 residential housing units that could be served by gravity sewer within this project area with a projected average daily flow of 6,600 GPD (sanitary flow of 4,600 GPD and infiltration flow of 2,000 GPD).

The estimated cost for this project is \$930,000. Phases I and II of the Northern Merrimack interceptor extension must be constructed before this project (Projects 10 and 23).

3.6.2.6 Project 24: Patten Road Southwest Collector Sewers

This project involves constructing approximately 5,150 linear feet of 8-inch diameter collector sewers to the southwest of Patten Road including part of Baboosic Lake Road, Carrie Drive, Madison Lane and part of Maidstone Drive. Refer to Figure 3-15 for the extents of the proposed project area.

FIGURE 3-15
PROJECT 24: PATTEN ROAD SOUTHWEST
COLLECTOR SEWERS



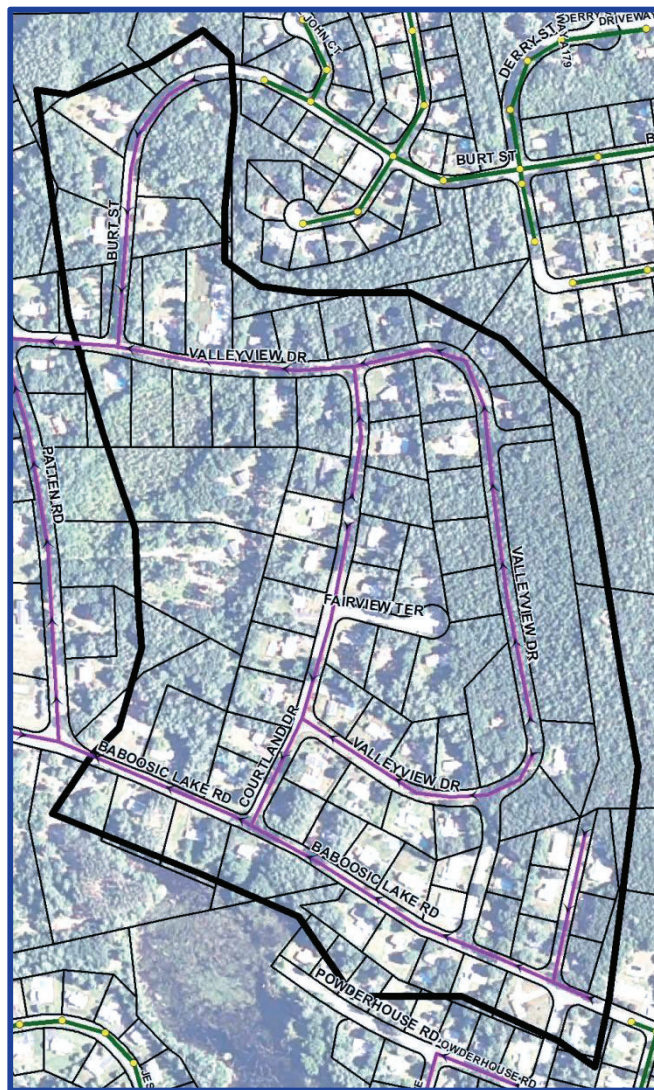
There are approximately 54 residential housing units that could be served by gravity sewer within this project area with a projected average daily flow of 13,700 GPD (sanitary flow of 11,300 GPD and infiltration flow of 2,400 GPD).

The estimated cost for this project is \$1,430,000. Phases I, II and II of the Northern Merrimack interceptor extension must be constructed before this project (Projects 10, 23 and 33).

3.6.2.7 Project 28: Patten Road Southeast Collector Sewers

This project involves constructing approximately 8,980 linear feet of 8-inch diameter collector sewers to the southeast of Patten Road including part of Baboosic Lake Road, Quincy Lane, Courtland Drive, Valleyview Drive and part of Burt Street. Refer to Figure 3-16 for the extents of the proposed project area.

**FIGURE 3-16
PROJECT 28: PATTEN ROAD
SOUTHEAST COLLECTOR SEWERS**



There are approximately 84 residential housing units that could be served by gravity sewer within this project area with a projected average daily flow of 21,700 GPD (sanitary flow of 17,600 GPD and infiltration flow of 4,100 GPD).

The estimated cost for this project is \$2,500,000. Phases I, II and II of the Northern Merrimack interceptor extension must be constructed before this project (Projects 10, 23 and 33).

3.6.2.8 Project Grouping 2 Cost Summary

The cost summary to construct the proposed interceptors/siphon and gravity sewers in Project Grouping 2 is as follows:

Interceptors/Siphon	\$4,860,000
Gravity Sewers	<u>\$10,930,000</u>
Total Project Grouping 2 Cost	\$15,790,000

3.6.3 Project Grouping 3

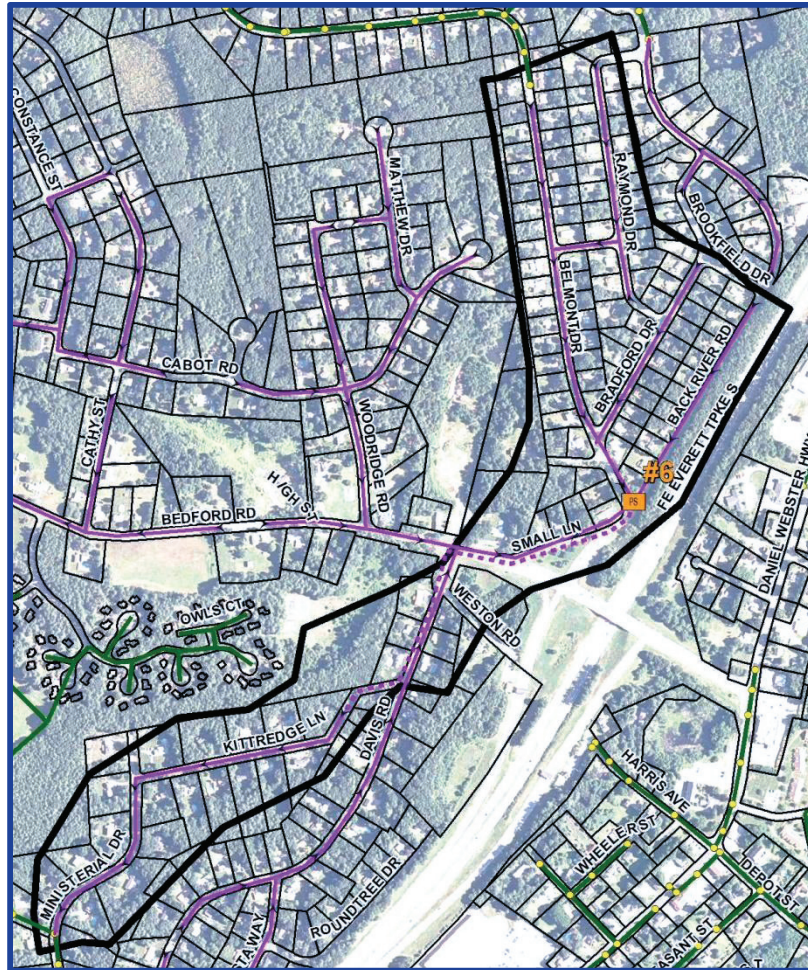
This project grouping consists of three different projects to provide sewer to neighborhoods to the north and south of Bedford Road near the F.E. Everett Turnpike. The new sewers will drain to the existing interceptor at the south end of Ministerial Drive. Each individual project is summarized below.

3.6.3.1 Project 14: Ministerial Drive Collector Sewers and Pump Station No. 6

This project involves constructing approximately 8,380 linear feet of 8-inch diameter collector sewers in part of Ministerial Drive, Kittredge Lane, part of Bedford Road, Small Lane, Back River Road, Bradford Drive, Raymond Drive and part of Belmont Drive. It also involves constructing Pump Station No. 6 on Back River Road and approximately 2,250 linear feet of force main to convey flows to the existing interceptor at the south end of Ministerial Drive. The pump station will see peak flows of approximately 189,500 GPD and will likely be a suction lift style station sized for 150 GPM. Note that approximately 2,200 linear feet of this sewer and the

pump station and force main will also collect flows from the Davis Road North Collector Sewers and Woodridge Road Collector Sewers projects (Projects 19 and 21). Refer to Figure 3-17 for the extents of the proposed project area.

FIGURE 3-17
PROJECT 14: MINISTERIAL DRIVE COLLECTOR
SEWERS AND PUMP STATION NO. 6



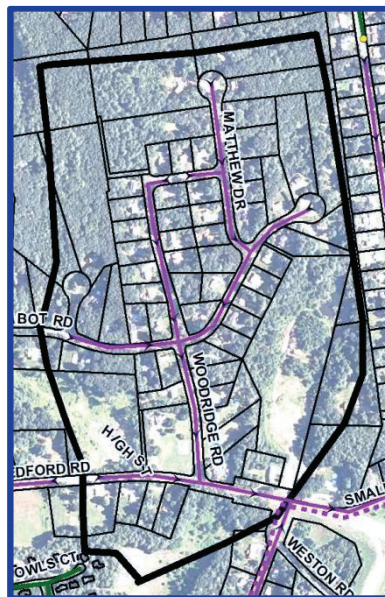
There are approximately 118 residential housing units that could be served by gravity sewer within this project area with a projected average daily flow of 28,500 GPD (sanitary flow of 24,800 GPD and infiltration flow of 3,700 GPD).

The estimated cost for the portion of this project that will collect flows from the other project areas is \$1,720,000 (pump station and force main included) and for the remaining collector sewers is \$1,690,000 for a total project cost of \$3,410,000.

3.6.3.2 Project 21: Woodridge Road Collector Sewers

This project involves constructing approximately 6,380 linear feet of 8-inch diameter collector sewers in Woodridge Road, part of Bedford Road, Matthew Drive, Brewster Street and part of Cabot Road. Refer to Figure 3-18 for the extents of the proposed project area.

**FIGURE 3-18
PROJECT 21: WOODRIDGE
ROAD COLLECTOR
SEWERS**



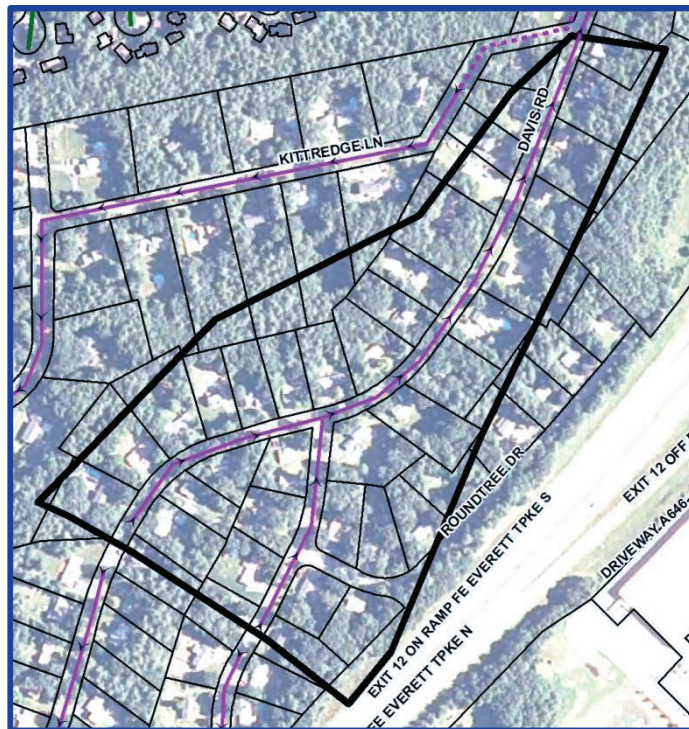
There are approximately 61 residential housing units that could be served by gravity sewer within this project area with a projected average daily flow of 15,700 GPD (sanitary flow of 12,800 GPD and infiltration flow of 2,900 GPD).

The estimated cost for this project is \$1,770,000. The Ministerial Drive Collector Sewers and Pump Station No. 6 project must be constructed before this project (Project 14).

3.6.3.3 *Project 19: Davis Road North Collector Sewers*

This project involves constructing approximately 3,100 linear feet of 8-inch diameter collector sewers in part of Davis Road and part of Vista Way. Refer to Figure 3-19 for the extents of the proposed project area.

**FIGURE 3-19
PROJECT 19: DAVIS ROAD NORTH
COLLECTOR SEWERS**



There are approximately 37 residential housing units that could be served by gravity sewer within this project area with a projected average daily flow of 9,200 GPD (sanitary flow of 7,800 GPD and infiltration flow of 1,400 GPD).

The estimated cost for this project is \$860,000. The Ministerial Drive Collector Sewers and Pump Station No. 6 project must be constructed before this project (Project 14).